

# Climate of Portland

## I. Revision Notes.

This is the fourth revision of the Climate of Portland, providing data through early 2018. New additions to this study include an abbreviated record set for the years of 1871 to 1940 (*found near the end of this study*). In some instances, the monthly totals will be included with the more recent data.

Portland weather records began in the 1870s, but the records used are often for the main observing site. For Portland, this would be the Portland International Airport (PDX), where weather observations have been continuous since October 1940. Prior to October 1940, weather records were taken at various locations in and near downtown Portland.

## II. Geographical Overview.

Portland is situated at roughly twenty feet above sea level near the confluence of the

Willamette and Columbia River, about 65 miles inland from the Pacific Ocean. Portland lies midway between the Coast Range to the west and the high Cascades Range to the east, each about 30 miles distant. The skyline is dominated by two volcanoes: Mount St. Helens (8300 feet high) 40 miles northeast, and Mount Hood (11,385 feet) 40 miles east.

Portland is also located at the northern end of the Willamette River Valley, a rich and diverse agricultural region. The long growing season and mild temperatures are favorable for a diversity of agricultural products.

During the summer, irrigation is widely used to raise cannery crops, berries and hay. Table beets, green beans, sweet corn, carrots, and pumpkins are grown in large quantities, then processed at the many processing centers in the Willamette Valley. Peaches, pears, cherries, plums and berries are also canned, with cherries and pears being the most numerous. Other major agricultural crops include apples, prunes, peppermint, spearmint, grass and grass seed, flowers, trees and shrubs, tomatoes, cucumbers, hazelnuts, and grapes (mostly used in wine production).

## III. Climatological Summary.

The Coast Range provides the Portland area limited shielding from the Pacific Ocean storms. The Cascades offer a steep slope for orographic lift of moisture-laden westerly winds, resulting in moderate rainfall for the region. The Cascades also act as a barrier, preventing the colder continental air masses that originate in the arctic areas of Canada, from invading western Oregon. Occasionally, however, cold air does work its way into western Oregon through the Columbia River Gorge, which lies east of Portland.



Rain is a part of life during the winter months. Nearly 90 percent of the annual rainfall occurs between mid-October and mid-May. In fact, only about 3 percent of our rain occurs in July and August. It is not uncommon to see relatively dry summers in Portland. Rain varies across the Portland metropolitan area. The West Hills receive 60 inches of rain per year, but the airport only receives about 36 inches (*see figure 2*).

Precipitation falls mostly as rain, with an average of only four days per year recording measurable snow. Snow accumulations are rarely more than two inches, and often melt within a day. Most likely areas of snow will be the higher terrain above 500 feet (which includes the West Hills), or near the Columbia Gorge at Troutdale, located on Portland=s east edge.

The winter season is characterized by mild temperatures, cloudy skies, and rain. Winds are predominately either southerly during the mild rainy spells, or easterly during the colder dry spells. Outbreaks of cold arctic air from east of the Cascades will occasionally spill into Portland, bringing cold blustery east winds. If the east winds occur when the rain is falling over the metropolitan area, a shallow layer of sub-freezing air forms along the Columbia River. In this cold layer, freezing rain and even snow at times will occur over eastern and northern Portland.

The cold easterly winds also bring the coldest air of the year to Portland. Temperatures below zero degrees are rare, occurring only six times since 1871. Most temperatures during the winter reach the 40s and lower 50s in the daylight hours, then fall into the 30s at night.

Spring is a transitional time as the weather pattern shift from winter to summer. However, spring is not all that warm, and

often, not all that dry. March and April are often damp and cool, with only a few warm dry days. May and June turn more dry, and see the most of the warming weather. Generally, afternoon temperatures warm from the 60s/70s in May to the 70s/lower 80s in June. However, it is not uncommon to see temperatures into the 80s or 90s. Memorial Day 1983 say 100 degree heat! Even though the number of rainy days decreases in May and June, there are still plenty of cloudy days.

Summer finally arrives in early July, when afternoon highs in the 80s occur with regularity. High pressure over the Pacific builds in the summer, with northwesterly winds prevailing in the afternoons and evenings. This high also shuts off the moisture source, allowing summers to often be dry and warm. Temperatures will often reach the lower to middle 90s, but these warm days do not last long before the cooler ocean air moves inland and cools the region back into the 70s. Temperatures above 100 degrees are rare, but usually occur in July and/or August.



**Figure 2 :** Portland-Vancouver metropolitan area.

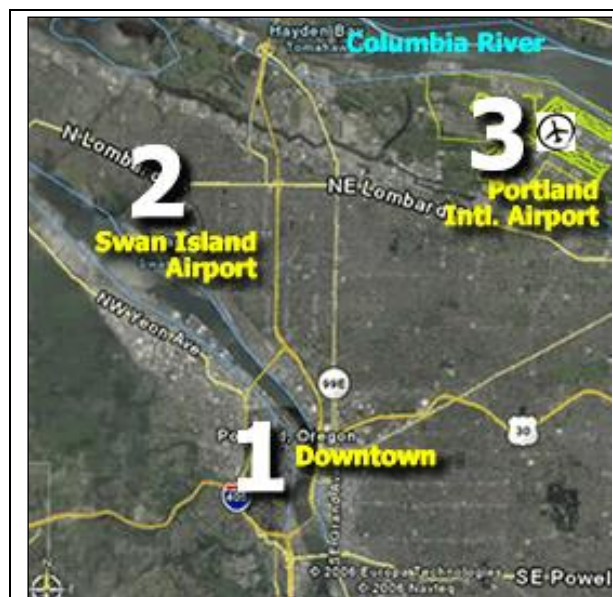
Autumn is the reverse of spring. September is still warm and dry, but by early to mid-October, fall arrives with high temperatures back into the 60s. As the night time hours increase, the valley cools more, allowing fog to form on clear nights. Fog can be quite dense during the late night and early morning hours, and can persist for several days.

Destructive storms are rare in Portland. Surface winds seldom exceed gale force (50 mph or greater) and have rarely exceeded 75 mph. Thunderstorms can occur during any month, but are not common. Thunderstorms in the winter and spring are weak, producing small hail and brief gusty winds. However, those in summer can produce prolific lightning, strong winds and large hail. Occasionally, thunderstorms will produce funnel clouds, but tornadoes are rare. The most famous tornado occurred on 5 April 1972. It produced \$4 million damage, killed 6 persons, and injured over 300 people as it scoured across north Portland into Vancouver.

On average, the last occurrence of 32 degrees in the spring is March 30<sup>th</sup>, while the first of the fall occurs around November 8<sup>th</sup>. First frost of fall is often around October 21<sup>st</sup>, while the last frost of spring is typically near April 26<sup>th</sup>. This makes for a long growing season.

#### IV. Station Observing History.

Official weather records for Portland began on November 1<sup>st</sup>, 1871 when the Signal Corps of the United States Army established a station in downtown Portland. Prior, weather records were fragmentary. The Signal Corps took weather observations until the end of June 1891. On July 1<sup>st</sup>, 1891, the weather observations and meteorological work of the federal government was taken over by the newly formed United States



**Figure 3:** Portland's official observation sites. Various downtown sites (1871-1928), the Swan Island Airport (1928-1940), and finally, Portland Int'l Airport (1940-present).

Weather Bureau, under the Department of Agriculture (*in 1940*,

*the Weather Bureau was transferred to the Department of Commerce).*

On November 1<sup>st</sup>, 1871, the first weather station was established in the Gilman Building, located at what is presently the corner of SW First Avenue and Alder Street. Nearly a year later, on December 21<sup>st</sup>, 1872, the weather station was moved to the Parish Building, located at Front Avenue and Washington Street.

Several years later, on January 1<sup>st</sup>, 1878, the station moved again, this time to the Oregon and Washington Trust Company's bank building at 48 (old city numbering) SW First Avenue. On August 1<sup>st</sup>, 1885, it moved to the Kamm Building at SW First and Pine. However, on October 5<sup>th</sup>, 1892, a fire in the Kamm Building forced another move to the Oregonian Building at SW 6<sup>th</sup> and Alder.



Finally, on June 8<sup>th</sup>, 1902, the weather station moved to the United States Customs House at 220 NW Eighth Avenue. Figure 3 shows the various observations sites since 1871.

At first, the thermometers were mounted in a shelter attached to a north window, but when the move was made to the Kamm Building, the shelter was the shelter was placed on the roof, and subsequent downtown sites placed the shelters on rooftops. Throughout the period of record, the rain gauges have also been on the roofs. Table below shows the elevation of the roofs above ground level.

<b>Building</b>	<b>Height of Roof</b>
Parish Building	47 feet
Oregon/Washington Trust	51 feet
Kamm Building	76 feet
Oregonian Building	196 feet
U. S. Customs House	63 feet

A self-recording weighing rain gauge was installed on February 11<sup>th</sup>, 1890. It was replaced by a bucket-type gauge on June 8<sup>th</sup>, 1902. Exposure of wind instruments was similar to that of the rain gauges, only set ten feet higher.

Self-registering thermometers, which indicate the daily maximum and minimum temperatures, were installed in July 1874. A thermograph was installed in June 1888, allowing a continuous record of temperature data. Recorded relative humidity began in January 1872, while a sunshine recorder arrived in January 1891.

On July 16<sup>th</sup>, 1928, the Portland Airport opened near what is presently the Swan Island Shipyards. The need for aviation weather support prompted a move of the downtown weather office to the new airport. Pilot weather briefings became a high priority of the new weather office. The weather recording instruments were moved

to the roof of the Swan Island administration building.

On September 30<sup>th</sup>, 1940, the weather stations moved again. This time, to the new Portland International Airport, located 9 miles northeast of downtown Portland on the south of the Columbia River. At this location, the thermometers and rain gauges were placed at ground level. The wind instruments were placed on the roof of the United Airlines hangar until February 1<sup>st</sup>, 1949, when they were moved about 250 feet west of the hangar to the roof of a service building.

During the summer of 1948, the famous Vanport flood occurred. It was the greatest flood on the Columbia River since 1894. Heavy rainfall and a large snowmelt had swollen the Columbia River, eventually collapsing a river dike near Vanport, presently known as the Delta Park area. The flood waters inundated the town of Vanport and the river valley for over 40 days, forcing the weather office to temporarily relocate to the Customs House in downtown Portland. The office returned to operations at the airport in August 1948.

In July 1994, the forecast office moved to NE 122<sup>nd</sup> Avenue, about 5 miles east of the airport. However, the observations continued at the airport location. On November 1<sup>st</sup>, 1995, ASOS (Automated Surface Observation System) became operational.

## **V. Updating this Study.**

For future updates to the data in this study, refer to the latest climatic data published by the National Climatic Data Center, or contact the National Weather Service in Portland.

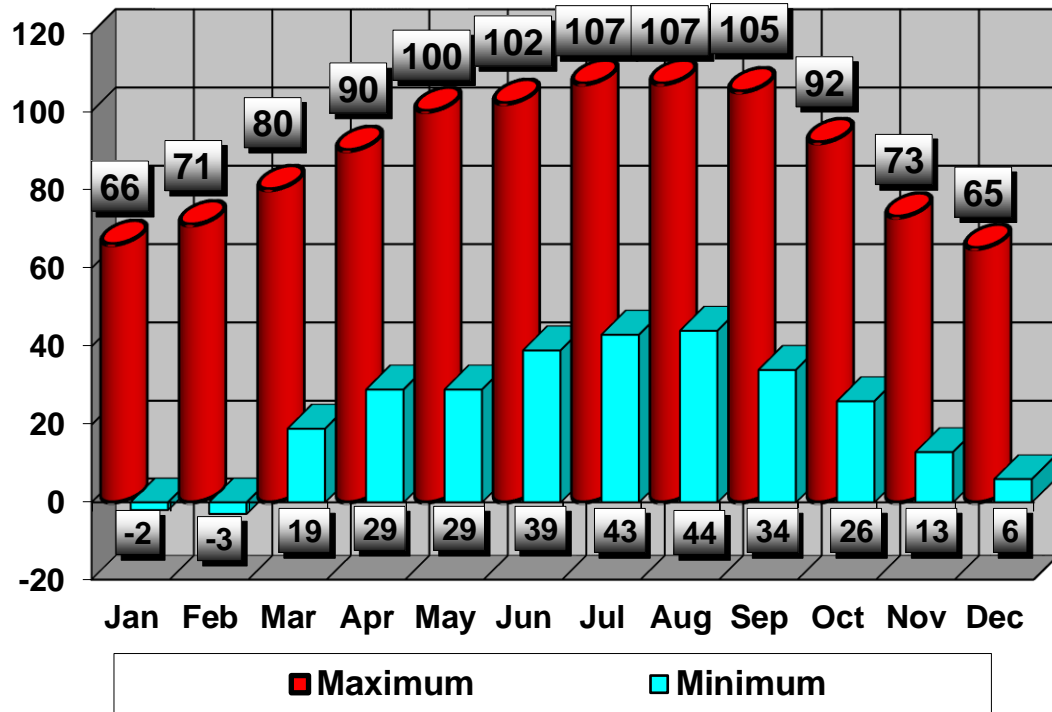
Portland data is also available on our website:

<http://weather.gov/Portland>

# Temperature Records & Data

## Extreme Airport Temperatures

(October 1940 - December 2019)



**Portland Airport: Monthly Extremes (Oct 1940 through Dec 2017)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
<b>Warmest</b>	66°	71°	80°	90°	100°	102°	107°	107°	105°	92°	73°	65°	107°
<i>Year</i>	2005	1988	1947	1998	1983	2006	1965	1981	1988	1987	1975	1983	1981
<b>Coldest</b>	-2°	-3°	19°	29°	29°	39°	43°	44°	34°	26°	13°	6°	-3°
<i>Year</i>	1950	1950	1989	1955	1954	1966	1955	1980	1965	1971	1985	1964	1950

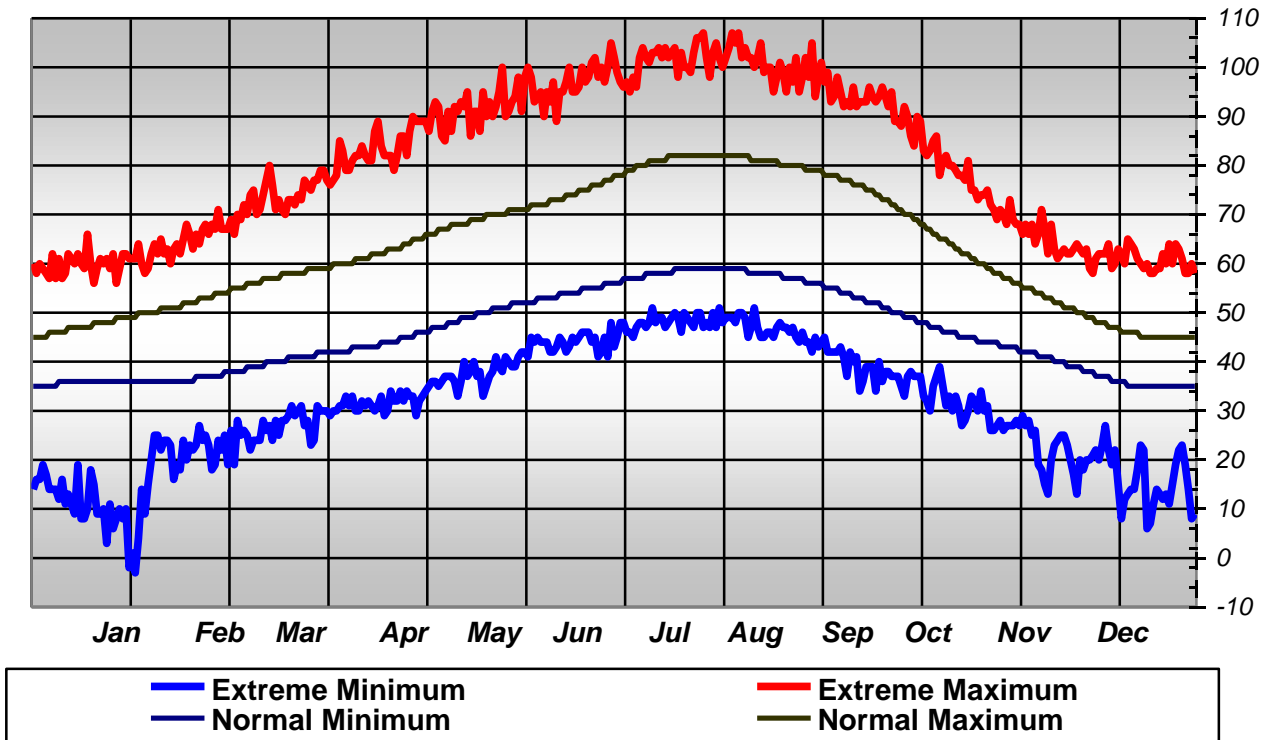
**Portland Downtown: Monthly Extremes (1874 through Dec 2019)**

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
<b>Warmest</b>	65°	75°	83°	93°	103°	102°	107°	106°	103°	92°	73°	67°	107°
<i>Year</i>	2005	1968	1930	1926	1983	1942	1942	1981	1988	1987	1890	1993	1942
<b>Coldest</b>	-2°	7°	20°	28°	32°	39°	43°	43°	35°	29°	11°	3°	-2°
<i>Year</i>	1888	1950	1896	1875	1894	1899	1904	1876	1908	1935	1896	1919	1888

# Airport Daily Temperatures

## Extremes and Normals

(1940-2019)



## Portland Airport: Climatic Normals (1981-2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Max Temp	47.0	51.3	56.7	61.4	68.0	73.5	80.6	81.1	75.8	63.8	52.8	45.6	<b>63.2</b>
Min Temp	35.8	36.3	39.6	43.1	48.6	53.6	57.8	58.0	53.1	46.0	40.5	35.2	<b>45.7</b>
Mean Temp	41.4	43.8	48.2	52.3	58.3	63.6	69.2	69.5	64.5	54.9	46.6	40.4	<b>54.5</b>

## Portland Downtown: Climatic Normals (1981-2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Max Temp	46.9	50.8	56.0	60.8	67.4	72.9	79.6	80.1	74.6	62.9	52.0	45.1	<b>62.5</b>
Min Temp	37.5	38.4	41.0	44.0	48.9	53.3	57.4	58.0	54.2	47.6	41.4	36.5	<b>46.6</b>
Mean Temp	42.2	44.6	48.5	52.4	58.1	63.1	68.5	69.0	64.4	55.2	46.7	40.8	<b>54.5</b>